

# AQUACULTURE

## Curriculum Content Framework

**Please note: All assessment questions will be taken from the knowledge portion of these frameworks.**

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# Curriculum Content Framework

## AQUACULTURE

Grade Levels: 10, 11, 12

Course Code: 491190

Prerequisites: Agricultural Science & Technology or Agricultural Science

Course Description: This course is the science of water farming. It includes the production and marketing of aquatic animals and plants. Opportunities are provided for students to participate in FFA and supervised experience activities.

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# Unit 1: Introduction to and History of the Aquaculture Industry

## 6 Hours

Terminology: aquaculture, bait aquaculture, brackish water, captured aquafood, closed system, cultured aquacrop, extensive aquacrop, food aquacrop, freshwater aquacrop, intensive aquacrop, mariculture, monoculture, open system, ornamental aquaculture, polyculture, production intensity, raceways, recreational aquaculture, seafood, stock enhancement, tank, water

<b>CAREER AND TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC AND WORKPLACE SKILLS</b> What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
1.1 Define terms	1.1.1	Foundation	Reading	Uses written resources (books, dictionaries, directories) to obtain factual information [1.3.23]
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]
		Thinking	Knowing How to Learn	Locates appropriate learning resources to acquire new skills or improve skills [4.3.3]  Processes new information as related to workplace [4.3.5]
1.2 List and explain the uses of aquacrops	1.2.1 Identify local producers of aquacrops for various uses	Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]  Determines what information is needed [1.3.10]  Interprets drawings to obtain factual information [1.3.17]
		Thinking	Seeing Things in the Mind's Eye	Imagines the flow of work activities from narrative descriptions [4.6.1]  Organizes and processes images—symbols, pictures, graphs, objects, etc. [4.6.2]  Visualizes a system's operation from schematics [4.6.3]  Visualizes a finished product [4.6.4]
1.3 Identify species of aquacrop produced locally and explain habitat requirements	1.3.1 List general descriptive characteristics of each species, including the required water environment	Foundation	Science	Applies scientific principles related to aquaculture [1.4.5]
	1.3.2 Observe production systems used with identified species	Personal Management	Responsibility	Maintains a high level of concentration in completion of task [3.4.7]

			Integrity/ Honesty/ Work Ethic	Complies with safety and health rules in a given work environment [3.2.2]		
1.4	Identify production levels of selected aquaculture species	1.4.1	Select an aquaculture species for a particular production situation	Foundation	Speaking	Participates in conversation, discussion, and group presentations [1.5.8]
		1.4.2	Distinguish between tank, pond, and raceway systems of production	Personal Management	Organizational Effectiveness	Responds to listener feedback [1.5.10]  Applies knowledge to implement work-related system or practice [3.3.4]
				Interpersonal	Cultural Diversity	Discusses contributions and innovations made by women and/or minority groups [2.2.2]
				Thinking	Creative Thinking	Develops visual aids to create audience interest [4.1.4]
1.5	Identify and describe facilities needed for aquaculture production by species	1.5.1	Plan facility needs for a selected aquaculture species	Foundation	Reading	Adjusts reading strategy to purpose and type of reading (skimming and scanning) [1.3.1]
		1.5.2	Consider available facilities in choosing aquaculture production systems			Identifies relevant details, facts, and specifications [1.3.16]  Uses written resources (books, dictionaries, directories) to obtain factual information [1.3.23]
				Personal Management Skills	Career Awareness, Development, & Mobility	Develops skills to locate, evaluate, and interpret career information [3.1.4]  Explores career opportunities [3.1.6]  Identifies education and training needed to achieve goals [3.1.8]

1.6	Outline aquaculture systems	1.6.1	Distinguish between closed and open systems	Foundation	Reading	Uses written resources (books, dictionaries, directories) to obtain factual information [1.3.23]
		1.6.2	Select the appropriate system for producing a particular species		Writing	Applies/Uses technical words and concepts [1.6.4] Uses words appropriately [1.6.21]
				Thinking	Problem Solving	Demonstrates logical reasoning in reaching a conclusion [4.4.2]
1.7	Discuss the history of early fish farming	1.7.1	Prepare a short paper on aquaculture and its history in the local area	Foundation	Reading	Adjusts reading strategy to purpose and type of reading (skimming and scanning) [1.3.1]  Identifies relevant details, facts, and specifications [1.3.16]  Uses written resources (books, dictionaries, directories) to obtain factual information [1.3.23]
					Writing	Communicates thoughts, ideas, or facts in written form in a clear, concise manner [1.6.6]
1.8	Discuss opportunities in FFA for students interested in aquaculture	1.8.1	Research a career in the aquaculture industry to determine education requirements, working conditions, and salaries of those working in aquaculture	Personal Management	Career Awareness, Development, & Mobility	Develops skills to locate, evaluate, and interpret career information [3.1.4] Explores career opportunities [3.1.6]  Identifies education and training needed to achieve goals [3.1.8]
1.9	Plan supervised agricultural experiences for students interested in aquaculture	1.9.1	Consider all types of SAE programs	Foundation	Arithmetic/ Mathematics	Chooses appropriately from a variety of mathematical techniques [1.1.11]
		1.9.2	Keep records on aquaculture SAE			

## Unit 2: Aquaculture Biology

### 15 Hours

Terminology: animalia, anterior, arteries, carbohydrate, dorsal, fat, fungi, gills, habitat, lateral, monera, osteichthyes, plantae, posterior, proteins, prostista, spawn, taxonomic name, taxonomy, veins, ventral, vitamins

CAREER AND TECHNICAL SKILLS What the Student Should be Able to Do			ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application		Skill Group	Skill	Description
2.1	Define terms	2.1.1	Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]
2.2	Name and distinguish aquaculture species between the taxonomic kingdoms	2.2.1	Foundation	Science	Acquires and processes scientific data [1.4.1]
		2.2.2			Thinking
				Reasoning	Demonstrates logical reasoning in reaching a conclusion [4.4.2] Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5] Sees relationship between two or more ideas, objects, or situations [4.5.5] Uses logic to draw conclusions from available information [4.5.6]
2.3	List and discuss the life processes of aquatic organisms	2.3.1	Foundation	Speaking	Communicates a thought, idea, or fact in spoken form [1.5.5]
		2.3.2	Thinking Skills	Reasoning	Comprehends ideas and concepts related to aquatic life processes



2.6	Discuss the circulatory and respiratory systems of aquatic species	2.6.1	Contrast circulatory and respiratory systems of finfish, crustaceans, and mollusks	Foundation  Thinking	Science  Problem Solving  Reasoning  Applies scientific principles related to water quality [1.4.5]  Solves practical problems using scientific methods and techniques [1.4.23]  Demonstrates logical reasoning in reaching a conclusion [4.4.2]  Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]  Sees relationship between two or more ideas, objects, or situations [4.5.5]  Uses logic to draw conclusions from available information [4.5.6]
2.7	Discuss the digestive systems and mouth positions of selected aquatic species	2.7.1	Dissect a fish to identify the parts of a digestive system	Foundation	Listening  Evaluates oral information/presentation [1.2.2]
		2.7.2	Relate digestive system and mouth position to food acquisition	Personal Management	Listens for content [1.2.3]  Receives and interprets verbal messages [1.2.8]  Responds nonverbally to conversation [1.2.9]  Science  Solves practical problems using scientific methods and techniques [1.4.22]  Integrity/ Honesty/ Work Ethic  Complies with safety and health rules in a given work environment [3.2.2]  Follows established rules, regulations, and policies [3.2.5]  Organizational Effectiveness  Adapts to the organization's goals, values, culture, and traditional modes of operation [3.3.1]  Applies knowledge to implement work-related system or practice [3.3.4]  Comprehends the organization's modes of operation [3.3.5]



## Unit 3: Safety with Aquaculture

### 5 Hours

Terminology: life saving equipment, material safety data sheet (MSDS), ring buoy, safety goggles

<b>CAREER AND TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC AND WORKPLACE SKILLS</b> What the Instruction Should Reinforce		
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>
3.1 Define terms	3.1.1	Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]
3.2 Discuss the meaning and importance of safety and safe work environment in aquaculture	3.2.1 Relate examples of safety hazards in aquaculture	Foundation	Reading	Distinguishes between fact and opinion [1.3.11]
	3.2.2 Have students name examples of accidents that have occurred locally in aquaculture		Speaking	Asks questions to obtain information [1.5.4]
3.3 Identify safety hazards in aquaculture	3.3.1 Survey hazardous situations in local aquaculture facilities and prescribe the appropriate safety measures to be taken and propose ways of eliminating or reducing the risk of these hazards	Foundation	Reading	Analyzes and applies what has been read to specific task [1.3.2]
	3.3.2 Develop a list of practices to reduce hazards in aquaculture facilities, particularly including electrical and water hazards	Personal Management	Integrity/ Honesty/ Work Ethic	Complies with safety and health rules in a given work environment [3.2.2]
		Thinking	Problem Solving	Devises and implements a plan of action to resolve problem [4.4.3]
3.4 Describe the importance of personal safety	3.4.1 Identify and properly use appropriate PPE with aquaculture	Thinking Skills	Problem Solving	Comprehends ideas and concepts related to safety with animals [4.4.1]
	3.4.2 Calculate the cost of PPE for an individual involved in aquaculture	Foundation	Arithmetic/ Mathematics	Calculates dollar amounts [1.1.7]
	3.4.3 Work together with others to promote safety in aquaculture, including locating safety devices such as float rings and life jackets	Interpersonal	Negotiation	Works to resolve conflict between two or more individuals [2.5.3]

## Unit 4: Water Facilities and Environments

### 20 Hours

Terminology: aquaria, aquifer, artesian well, cage, closed raceway, dissolved oxygen, ectotherm, gallons per minute (GPM), hardness, impoundments, industrial effluent, open raceway, pen, pollutant, pond, spring, stream, surface runoff, vat, water cycle, water pH, water quality, well

<b>CAREER AND TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC AND WORKPLACE SKILLS</b> What the Instruction Should Reinforce				
Knowledge	Application	Skill Group	Skill	Description		
4.1	Define terms	4.1.1	Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]	
4.2	Discuss the importance of water in aquaculture	4.2.1	Compare water from various sources as related to its quality for the culture of aquatic species	Foundation	Science	Analyzes environmental issues (ecology, pollution, water management) [1.4.2]  Follows safety guidelines [1.4.16]  Solves practical problems using scientific methods and techniques [1.4.23]
			Interpersonal	Teamwork	Contributes to group with ideas, suggestions, and effort [2.6.2]  Takes an interest in what others say and do [2.6.5]	
			Thinking	Problem Solving	Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]	
4.3	Describe the water (hydrologic) cycle	4.3.1	Explain the processes in the water cycle, including evaporation, precipitation, and percolation	Foundation	Science	Analyzes environmental issues (ecology, pollution, water management) [1.4.2]  Follows safety guidelines [1.4.16]  Solves practical problems using scientific methods and techniques [1.4.23]
			Interpersonal	Teamwork	Contributes to group with ideas, suggestions, and effort [2.6.2]  Takes an interest in what others say and do [2.6.5]	
			Thinking	Problem Solving	Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]	

4.4	Describe the quality of water based on salinity	4.4.1	Distinguish between freshwater, saltwater, and brackish water	Foundation	Reading	Draws conclusions from what is read [1.3.12]
		4.4.2	Match aquaculture species with water based on salinity		Science	Applies knowledge to complete a practical task [1.4.3]
4.5	Identify and describe water facilities used in aquaculture	4.5.1	Compare the environmental features of various water facilities	Foundation	Listening	Comprehends ideas and concepts related to water quality [1.2.1]
		4.5.2	Match aquaculture species with appropriate water facilities	Thinking	Decision Making	Evaluates information/data to make best decision [4.2.5]
4.6	Discuss types and components of tank systems used in aquaculture	4.6.1	Compare various types of tanks and tank systems	Foundation	Speaking	Adapts presentation to audience [1.5.1]
		4.6.2	Distinguish between open, recirculation, and closed systems		Science	Constructs model to depict basic concept of a recirculation system
		4.6.3	Label the major parts on a drawing of a recirculation system	Thinking	Creative Thinking	Makes connections between seemingly unrelated ideas [4.1.6]
4.7	List and explain factors in selecting a water facility	4.7.1	Observe an aquaculture facility and prepare a report on its operation	Foundation	Speaking	Communicates a thought, idea, or fact in spoken form [1.5.5]
		4.7.2	Prepare a poster that lists factors associated with land availability and past use, available water, labor supply, market availability, and personal preferences		Thinking	Decision Making
4.8	Describe the sources of water for aquaculture	4.8.1	Identify and assess the potential of water sources in the local area, including wells, ponds, streams, municipal systems, and surface runoff	Foundation	Science	Applies scientific principles related to water quality [1.4.5]
				Thinking	Reasoning	See relationship between two or more ideas, objects, or situations [4.5.5]
4.9	Explain how water well production is measured as gallons per minute (GPM)	4.9.1	Calculate time requirements for supplying water needs based on well production	Foundation	Science	Applies knowledge learned through study and practices that is based on techniques
					Arithmetic/ Mathematics	Calculates/Estimates production of water wells as related to aquaculture needs [1.1.8]

4.10	List water quality factors related to suitability of water for aquaculture	4.10.1	Assess samples of water from various sources to determine quality	Foundation	Science	Analyzes environmental issues (ecology, pollution, waste management) [1.4.2]
		4.10.2	Use water test kits and meters in determining water quality	Thinking	Seeing Things in the Mind's Eye	Uses equipment and techniques in assessing water quality [1.4.23] Visualizes a system's operation from schematics [4.6.3]
4.11	Describe the impacts that dissolved oxygen, temperature, pH, and hardness have on water quality	4.11.1	Use a dissolved oxygen meter to determine the DO level of water	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]
		4.11.2	Determine if fish and other aquatic species could live and grow in water with the DO reading that was measured	Thinking	Creative Thinking	Chooses appropriately from a variety of scientific methods and techniques to complete a task [1.4.9]
		4.11.3	Demonstrate methods of correcting dissolved oxygen deficiency			Converts quantities and measurements from one form to another [1.4.13] Monitors variables in experiment [1.4.18]
				Problem Solving	Finds new ways of dealing with existing problems/situations [4.1.5] Prepares presentation based on subject research, interviews, surveys [4.1.10] Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]	
4.12	Discuss factors that affect dissolved oxygen	4.12.1	Determine the temperature of a water sample	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]
		4.12.2	Determine DO levels in water samples of various temperatures	Interpersonal	Science	Uses equipment and techniques to measure dissolved oxygen in water [1.4.23]
		4.12.3	Determine the pH of a water sample with a pH meter		Career Awareness, Development, & Mobility	Analyzes impact of work on individual and family life [3.1.1]

## Unit 5: Water Quality Management

### 15 Hours

Terminology: aeration, ammonia, biological oxygen demand, biological weed control, chemical weed control, environmental weed control, mechanical weed control, oxygenation, oxygen depletion, parts per million (ppm), turbidity

<b>CAREER AND TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC AND WORKPLACE SKILLS</b> What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
5.1 Define terms	5.1.1	Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]
5.2 List water quality characteristics	5.2.1 Sample water from a pond to determine quality , including DO, ammonia, alkalinity, and salinity	Foundation	Science	Analyzes environmental issues (ecology, pollution, water management) [1.4.2]
	5.2.2 Determine common measures used with aquaculture water, including ppm			Follows safety guidelines [1.4.16]
				Solves practical problems using scientific methods and techniques [1.4.23]
		Interpersonal	Teamwork	Contributes to group with ideas, suggestions, and effort [2.6.2]
		Thinking	Problem Solving	Takes an interest in what others say and do [2.6.5]
				Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]
5.3 Explain the physical and biological characteristics of water	5.3.1 Assess the physical and biological characteristics of water from selected sources	Foundation	Science	Analyzes environmental issues (ecology, pollution, waste management) [1.4.2]
		Thinking	Seeing Things in the Mind's Eye	Visualizes a system's operation from schematics [4.6.3]
5.4 List the common signs of oxygen depletion	5.4.1 Observe aquaculture facilities for signs of oxygen depletion	Foundation	Science	Applies scientific principles related to water quality [1.4.5]
	5.4.2 Determine conditions that contribute to current oxygen level in a water sample			

5.5	List and explain the causes of oxygen depletion	5.5.1	Observe aquaculture facilities for the presence of conditions that may lead to oxygen depletion	Foundation	Science	Applies scientific principles related to water quality [1.4.5]
5.6	Explain how oxygen can be added to water with low DO	5.6.1	Experiment with aeration by testing water before and after oxygenation practices	Foundation	Science	Applies scientific principles related to water quality [1.4.5]
5.7	List methods of getting dissolved oxygen into water	5.7.1	Apply methods of aeration with aquaculture water	Foundation	Reading  Writing  Creative Thinking	Determines what information is needed [1.3.10]  Identifies relevant details, facts, and specifications [1.3.16]  Adapts notes to a proper form [1.6.1]  Summarizes written information [1.6.17]  Writes/Prints legibly [1.6.24]  Combines ideas or information in new way [4.1.2]  Makes connections between seemingly unrelated ideas [4.1.6]
5.8	Determine the causes of turbidity	5.8.1	Assess sources of turbidity in aquaculture water	Foundation	Listening	Comprehends ideas and concepts related to water quality [1.2.1]
		5.8.2	Assess aquaculture water for turbidity		Science	Uses equipment and techniques in assessing turbidity [1.4.23]
		5.8.3	Use a secchi disk to measure turbidity	Thinking	Decision Making	Evaluates information/data to make best decision [4.2.5]
5.9	Describe the methods used to control turbidity	5.9.1	Apply a method of turbidity control to a water environment	Foundation	Listening	Comprehends ideas and concepts related to water quality [1.2.1]
				Thinking	Decision Making	Evaluates information/data to make best decision [4.2.5]





## Unit 6: Disease and Pest Management

### 15 Hours

Terminology: abscess, dipping, direct pest loss, disease, external parasite, feed additive, indirect disease loss, internal parasite, lesion, parasite, pest, predator, quarantine, sanitation, symptom, trash fish, vigor

<b>CAREER AND TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC AND WORKPLACE SKILLS</b> What the Instruction Should Reinforce			
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>	
6.1	Define terms	6.1.1	Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]
6.2	Explain how an aquaculture environment may be a good place for harboring diseases and pests	6.2.1 Interview a fish producer to determine the health management practices that are followed	Foundation	Listening	Listens for content [1.2.3]  Listens to follow directions [1.2.6]  Listens for long-term contexts [1.2.7]
			Personal Management	Writing	Checks, edits, and revises document for correct information, appropriate emphasis, form, grammar, spelling, and punctuation [1.6.5]  Summarizes written information [1.6.17]  Uses language, style, organization, and format appropriate to subject matter, purpose, and audience [1.6.19]
				Self-esteem	Creates self-confidence by creating a resume that promotes personal strengths/abilities [3.5.3]  Presents positive image of personal attitudes and abilities [3.5.7]





## Unit 7: Marketing 14 Hours

Terminology: advertising, basic processing, deheading, dressed, eviscerating, eyed eggs, fry, fingerling, fillet, grading, live hauling, live product form, marketing, marketing channel, processing, skinning

CAREER AND TECHNICAL SKILLS What the Student Should be Able to Do			ACADEMIC AND WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge		Application	Skill Group	Skill	Description
7.1	Define terms	7.1.1	Foundation	Reading	Applies/Understands technical words that pertain to subject [1.3.6]
7.2	Discuss the meaning and importance of marketing in the success of an aquaculture enterprise	7.2.1	Knowledge	Listening	Comprehends ideas and concepts related to aquaculture marketing [1.2.1]
		7.2.2		Reading	Comprehends written information for main ideas [1.3.7]
7.3	Explain aquaculture marketing and the marketing channels that are used	7.3.1	Foundation	Arithmetic/ Mathematics	Applies mathematical principles related to marketing aquatic products [1.1.4]
		7.3.2	Thinking	Knowing how to Learn	Applies new knowledge and skills to marketing aquatic products [4.3.1]
		7.3.3			
7.4	Describe live aquaculture product forms	7.4.1	Foundation	Writing	Organizes information in an appropriate format [1.6.10]
			Thinking	Creative Thinking	Combines ideas or information in new ways [4.1.2]
7.5	Explain the “dressing” process in the aquaculture industry	7.5.1	Foundation	Speaking	Applies/Uses technical terms as appropriate to audience [1.5.2]
			Personal	Arithmetic/ Mathematics	Applies a mathematical formula to solve a problem [1.1.3]
				Responsibility Management	Pays close attention to details [3.4.8]
7.6	Evaluate the types of processed forms and cuts of fish	7.6.1	Foundation	Speaking	Organizes ideas, and communicates oral messages to listeners [1.5.7]
			Personal Management	Responsibility	Exerts a high level of enthusiasm in approaching and completing tasks [3.4.3]
7.7	Develop an advertising campaign for a type of aquaculture product	7.7.1	Foundation	Speaking	Uses verbal language and other cues, such as body language, appropriate in style, tone, and level of complexity to the audience and the occasion

		Interpersonal	Customer Service	Comprehends ideas and concepts related to marketing aquatic products [2.3.2]
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# Glossary

## Unit 1: Introduction to and History of the Aquaculture Industry

1. aquaculture—the production of aquatic plants, animals, and other species
2. bait aquaculture—raising of small fish and other species for use as bait
3. brackish water—mixture of fresh and salt water
4. captured aquafood—plants, animals, and other species that grow in the wild and are caught for human use
5. closed system—an aquaculture system that uses filters and pumps to recycle the water and minimize water usage
6. cultured aquacrop—a species of aquatic organism that is raised in a somewhat controlled environment
7. extensive aquacrop—production systems with low population density
8. food aquacrop—an aquatic species produced almost exclusively for human food
9. freshwater aquacrop—growing aquatic organisms in fresh water
10. intensive aquacrop—producing aquacrops at a high population density
11. mariculture—producing aquatic crops in salt water
12. monoculture—production system in which only one species is grown at a time
13. open system—an aquaculture system in which water is pumped into and out of the system for disposal
14. ornamental aquaculture—keeping fish and other aquatic species for aesthetic or personal appeal
15. polyculture—an aquaculture system in which two or more species are grown together
16. production intensity—density of the aquacrop in its water facility
17. raceways—long, narrow water enclosures that use flowing water
18. recreational aquaculture—raising aquatic species for sporting purposes
19. seafood—edible marine fish, shellfish, and other aquatic species that may be wild or cultured
20. stock enhancement—raising wild species in captivity for release into natural water; used to keep species from being depleted
21. tank—a round or rectangular water container used for aquaculture
22. water enclosure—a facility in which aquaculture takes place
23. water recirculation—pumping water back through an aquaculture system

## Unit 2: Aquaculture Biology

1. animalia—kingdom containing multicellular animals; fish and other aquatic organisms belong to this kingdom
2. anterior—the front end of a fish
3. arteries—vessels that carry blood from the heart
4. carbohydrate—food nutrient that provides energy; found in sugar, starch, and cellulose
5. dorsal—the back plane of a fish
6. fat—food nutrient comprised of fatty acids that help maintain health and proper growth
7. fungi—kingdom that contains true fungi, plants that do not produce their own food
8. gills—blood-filled membranes used by fish and other organisms to remove oxygen from the water
9. habitat—an environment in which an organism lives and thrives
10. lateral—the side plane of a fish
11. monera—kingdom that contains very primitive organisms, cells without membranes such as bacteria and blue-green algae
12. osteichthyes—scientific class that includes all fish that are important in aquaculture
13. plantae—kingdom composed of plants that produce their own food through photosynthesis
14. posterior—the tail end of a fish
15. proteins—feed nutrient made of amino acids
16. protista—kingdom that contains single-celled and very primitive multicelled organisms, such as slime molds and protozoa
17. spawn—the reproductive process in fish
18. taxonomic name—the scientific name of a species based on its genus and species
19. taxonomy—scientific classification system for arranging organisms into groups
20. veins—vessels that carry blood to the heart
21. ventral—the belly side of a fish
22. vitamins—an organic substance necessary for proper nutrition

## Unit 3: Safety in Aquaculture

1. life saving equipment—life jackets and other equipment that can be used to water safety or rescue an individual in event of an accident
2. material safety data sheet (MSDS)—information sheets that accompany chemicals providing details on safe use; MSDS information is also available via the internet
3. ring buoy—a round, doughnut-type, floating device that may be thrown to a person in the water; most ring buoys are tethered to a post or other secure object
4. safety goggles—flexible eye safety devices held securely in place by an elastic strap around the head

## Unit 4: Water Considerations & Facilities

1. aquaria—small, usually glass, tanks used for aquaculture, most often for ornamentals
2. aquifer—an underground formation of sand, gravel, or rock that contains water
3. artesian well—a well that produces water without pumping; the water is forced out by natural pressure
4. cage—a container for aquacrops that floats in the water, often used when other methods will not work
5. closed raceway—raceway in which the water is recycled
6. dissolved oxygen—the free oxygen in water that is available to aquatic organisms
7. ectotherm—an animal whose body temperature changes with changes in its environment
8. gallons per minute [GPM]—number of gallons of water a well can produce in a minute
9. hardness—amount of calcium and magnesium in water
10. impoundments—enclosures that hold water for aquaculture
11. industrial effluent—water released by manufacturing plants
12. open raceway—a raceway in which the water is used once and then removed from the system
13. pen—an enclosure, usually a net that is attached to the bottom of a lake, pond, etc.
14. pollutant—a substance that damages or degrades water, air, soil, or any part of the environment
15. pond—an artificial water impoundment made of soil
16. spring—a natural opening in the earth that produces water
17. stream—a flowing body of water, smaller than a river
18. surface runoff—water from precipitation that does not soak into the soil
19. vat—a long, rectangular water impoundment similar to a tank, usually made of concrete and not mobile
20. water cycle—the never ending circulation of the earth's water
21. water pH—the acidity or alkalinity of water
22. water quality—the suitability of water for a particular use
23. well—an opening made in the earth to obtain water

## Unit 5: Water Quality Management

1. aeration—exposing water to air so it will pick up oxygen
2. ammonia—a form of nitrogen found in water that is most toxic to fish
3. biological oxygen demand—amount of oxygen used by organisms, decay processes, and other functions in water
4. biological weed control—using plant-eating organisms to control weeds
5. chemical weed control—using herbicides to control weeds
6. environmental weed control—using environmental and facility design factors to control weeds
7. mechanical weed control—physically cutting or pulling weeds as a control method
8. oxygenation—adding dissolved oxygen to water, using mechanical, chemical, or other means
9. oxygen depletion—occurs when the level of oxygen in water drops below the level needed to maintain living conditions for an aquacrop
10. parts per million (ppm)—a measurement system for substances that are present in water in very small amounts, such as measurement of 2 ppm means that there are 2 parts of a substance in 1 million parts of water (parts per thousand is also sometimes used and is the measurement of the parts of a substance in 1 thousand parts of water)
11. turbidity—presence of particles in the water that make it appear cloudy or unclear

## Unit 6: Disease and Pest Management

1. abscess—a swollen area in body tissue that contains pus
2. dipping—treating a disease by immersing an organism in a therapeutic solution for a short time
3. direct pest loss—loss resulting when organisms are attacked, injured, or killed
4. disease—unhealthy; a condition that impairs an organism
5. external parasite—a parasite that lives on the outside of the body of its host
6. feed additive—substances added to feed; may include medications, vitamins, and other items put into feed for a specific purpose
7. indirect disease loss—loss of aquacrops resulting from an environment that is less than ideal
8. internal parasite—a parasite that lives in the organs, digestive tract, or other places inside of its host
9. lesion—a cut or other injury that creates wounds
10. parasite—an organism that lives in or on another organism (the host), depends on the host for its food, has a higher reproductive potential than the host, and may harm the host when present in large numbers
11. pest—an organism that is detrimental or interferes with other organisms or facilities
12. predator—an animal that attacks and feeds on other animals
13. quarantine—isolating organisms from each other
14. sanitation—keeping facilities clean, and using clean water for aquaculture
15. symptom—a sign that an organism is diseased
16. trash fish—undesirable fish in a crop of fish
17. vigor—movement of organisms typical for their species

## Unit 7: Marketing

1. advertising—calling the attention of possible consumers to a product, and encouraging them to buy it
2. basic processing—steps in fish processing that include deheading, eviscerating, and skinning; also known as dressing
3. deheading—removing the head of fish
4. dressed—killed and prepared for food market
5. eviscerating—removing the internal organs; also known as gutting
6. eyed eggs—fertile eggs beginning to show the development of the fish embryo
7. fry—the stage in a fish's life from the time it hatches until it reaches one inch (2.5 cm) in length
8. fingerling—the stage in a fish's life between one inch (2.5 cm) and one year of age
9. fillet—high quality piece of fish made by cutting parallel with the backbone so the product does not contain bones
10. grading—sorting aquacrops into batches of uniform size and species
11. live hauling—transporting live aquacrops to others who will use them in free lakes or for other purposes
12. live product form—marketing aquacrops that are alive
13. marketing—providing consumers with the products they desire
14. marketing channel—the steps or procedure followed to get a product to the consumer
15. processing—preparing an aquacrop into a convenient form for the consumer; includes preserving products to prevent spoilage
16. skinning—removing the skin from fish during processing